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On the Conjunction of Venus and λ *Geminorum.*

By John I. Plummer.

In a late number of the *Monthly Notices* (vol. xxxvi. p. 340) Mr. Dunkin has called attention to the proposal of Dr. Krüger, that astronomers in either hemisphere should avail themselves of the near approach of *Venus* to the bright star λ *Geminorum*, at a time when the planet was but little distant from the Earth, with the view of determining the solar parallax. It may, therefore, be of interest to the Fellows of the Society to record the degree of success that has attended the observations at the Orwell Observatory. The plan which it was proposed to pursue on the occasion, was to measure differences of declination of the planet and star, commencing as soon as *Venus* had attained an altitude of 20°, to be continued so long as circumstances would permit, since with the large aperture at my command (10 inches), no difficulty would be experienced in following up the observations to the time of actual conjunction in Right Ascension. Five comparisons of each limb of the planet with the star were to be made with a parallel-wire micrometer (power 315) alternately, and it was confidently expected that the probable error of the mean of each set would not exceed $\frac{1}{10}$th of a second of arc. Such a series would have been useful if corresponding observations had been made at any position in the southern hemisphere, and failing a preconcerted arrangement with a southern station, was the most satisfactory scheme that suggested itself to my mind.

Unhappily it was discovered on the morning of August 18, that the definition of the planet and star was not sufficiently sharp for the desired degree of accuracy to be ensured, and was at times so indifferent that I was doubtful whether measures avowedly so delicate ought not to be discontinued. They were, however, persevered in until $18^{h}\ 46^{m}$ G.M.T., when cirrus cloud overspread the sky, obliterating both objects for several hours. By this time 10 sets of 5 comparisons each had been obtained, and, although these may not fully serve the end for which they were undertaken, they quite unexpectedly throw light upon a question to which I have always attached some interest.

The following is a comparison of the observations with the Ephemeris of the *Nautical Almanac*, which has been made in order to test the reliability of the individual sets, assuming, for the purposes of reduction, the solar parallax equal to $8''\cdot90$, and the apparent declination of the star $+16°45'51''\cdot84$. It should be remarked that the north limb of the planet was full, and that the correction for defective illumination of the south limb was so small as to be quite insensible.

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Venus, N.L. — λ *Geminorum*.

Set.	Greenwich Mean Time of Observation. h m s		Uncorrected Difference of N.P.D. ′ ″	Assumed Semidiameter of *Venus*. ″	Differential Refraction Correction. ″	Correction for Parallax.	Observed N.P.D. of *Venus*—Calculated N.P.D.	Weight.
1	16 27 15·7	(*a*)	+1 46·587	+20·048	+0·116	−14·330	−0·315	4
3	16 56 40·5		+1 43·562	+20·042	+0·086	−13·891	+0·039	3
5	17 15 4·9	(*b*)	+1 42·144	+20·037	+0·074	−13·625	+0·729	2
7	17 53 31·4		+1 38·161	+20·029	+0·058	−13·111	+1·115	2
9	18 21 56·6		+1 34·259	+20·023	+0·049	−12·778	+0·396	3

Venus, S.L. — λ *Geminorum*.

Set.	Greenwich Mean Time of Observation. h m s		Uncorrected Difference of N.P.D. ′ ″	Assumed Semidiameter of *Venus*. ″	Differential Refraction Correction. ″	Correction for Parallax.	Observed N.P.D. of *Venus*—Calculated N.P.D.	Weight.
2	16 39 45·2		+2 26·611	−20·045	+0·141	−14·141	+1·094	3
4	17 5 6·4		+2 22·991	−20·040	+0·111	−13·771	+0·382	3
6	17 30 31·9		+2 19·915	−20·034	+0·092	−13·413	+0·219	2
8	18 9 16·3	(*c*)	+2 15·360	−20·025	+0·074	−12·913	+0·062	4
10	18 39 56·4	(*d*)	+2 10·274	−20·019	+0·065	−12·586	−1·611	1

Remarks—(*a*) Sky quite clear and images fairly steady.—(*b*) Shortly after sunrise the definition of the planet became gradually worse, and the star faint, large, and trembling.—(*c*) Definition of *Venus* much improved, and the star which had nearly disappeared is now smaller and more easily seen.—(*d*) Images bad again: cirrus cloud completely hid the star after four bisections, which were all that could be obtained with difficulty for this set. It is from the consideration of these remarks alone that weights have been assigned in the last column.

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In comparing the observations with the Ephemeris we may obviously employ whatever value of the planet's semidiameter we please, and I have, therefore, adopted that which best satisfies the observations themselves, namely 8″·698 at mean distance. This is very slightly larger than that determined by myself with the double-image micrometer in 1873 (8″·661), but is less than the well-known determination of Mr. Maine (8″·775). In spite of the unsatisfactory state of the sky, an analysis of the individual bisections shows that the probable error of a single set of observations does certainly not exceed 0″·21, and it was, therefore, very disappointing to deduce the marked discordances that occur in the 7th column. If, however, we assume that the apparent semidiameter of the planet, owing to irradiation, did not remain constant before and after sunrise, but diminished in proportion as the neighbouring sky became more and more illuminated, an explanation of these anomalous results is possible, and their true significance will be apparent when exhibited in the following form:—

			Weight as before.	Approx. G.M.T. of Observation. h	m	Group.
Mean excess of planet's observed N.P.D. over that of Ephemeris, giving weights as above	...	+0·268				
Apparent excess of observed semidiameter over that assumed in the previous reductions.	Set 1	+0·583	4	16	27	1
	„ 2	+0·806	3	16	40	
	„ 3	+0·229	3	16	57	2
	„ 4	+0·114	3	17	5	
	„ 5	−0·461	2	17	15	
	„ 6	−0·049	2	17	31	3
	„ 7	−0·847	2	17	54	
	„ 8	−0·206	4	18	9	
	„ 9	−0·128	3	18	22	
	„ 10	−1·879	1	18	40	
Greenwich Mean Time of Sunrise at Orwell Park			...	16	44	

Not only do these figures show a gradual decrease of the apparent semidiameter, and a more sudden diminution at the moment of sunrise, but dividing them into three groups and taking the mean of each we shall arrive at a pretty fair approximation to the amount of variation due to the several states of illumination of the sky. Thus the mean of sets 1 and 2 shows that before sunrise the contacts were made too *remote*, and the measured semidiameter was consequently too great, by the quantity 0″·679 (Wt. 7). The next three sets, which were taken when the Sun was very low, yield an average of only 0″·013 (Wt. 8), as the excess of the measured semidiameter over the assumed value. The mean of the sets 6–9, observed after the Sun had fairly freed itself from the haze of the horizon, shows

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the contacts to have been made too *close* by the quantity 0″·273 (Wt. 11), the observed semidiameter being too small by that amount. The final result shows unmistakeably that the effect of the cloud through which this set was observed had been to cut off the sharp cusp altogether, and to reduce the planet more or less to the oblong figure artificially produced by Mr. Christie.

In the paper to which I have already referred (*Monthly Notices*, vol. xxxiii. p. 562), I have stated that there can be little doubt that the amount of irradiation of the disk of *Venus* varies from day to day with the transparency of the atmosphere. I have only to add, that the preceding observations prove beyond question that such changes occur at much smaller intervals, and that near the hour of sunrise or sunset are of such magnitude as to require careful elimination in all observations of accuracy. Finally, we may conclude that for the determination of solar parallax by the method suggested by MM. Krüger and Dunkin, each limb of the planet will require to be observed simultaneously or nearly so, in order to evade this peculiarity; and that had this been provided for at both northern and southern stations a valuable result would most probably have been obtained.

Orwell Park Observatory,
1876, *December* 12.

Observations of Shooting Stars, April to December, 1876.

By W. F. Denning, Esq., F.M.S.

(*Communicated by the Rev. R. Main, M.A., F.R.S.*)

The following list of 51 radiant-points were deduced from the paths of 766 shooting stars observed and registered at Bristol during the nine months, April to December, 1876. About 1,050 were seen altogether within this period, but some of them (including a number of Perseids, Geminids, etc.) were not recorded, as their radiants had already been indicated with sufficient accuracy from other paths; and the remainder were not well seen, and accordingly had to be rejected. Previously to October my observations were made irregularly, and not often continued for long periods, but during the last three months of the year the sky was watched on every fine night for several hours, generally before midnight. This will account for my having seen many more meteors in the autumnal months than in the spring and summer. In October, November, and December, during watches amounting in the aggregate to 69½ hours, 532 meteors were seen, and 447 of them registered. Of the total number observed, 322 were noted in 49 hours' watching before midnight, and 210 of them in 20½ hours after midnight (chiefly between 3 and 6 A.M.), so that the rate of frequency A.M. greatly exceeded that P.M., and this was especially marked in November. During the preceding months I did very little work